

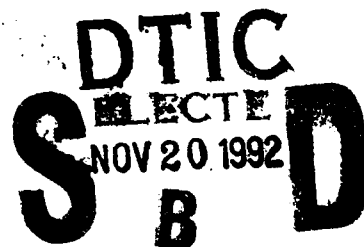
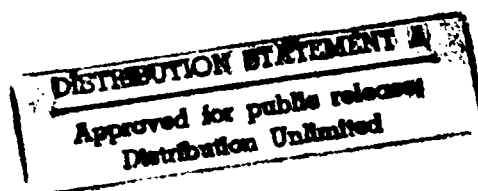
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FINAL REPORT
JULY 1991

REPORT NO. 91-04

MIL-STD-398 TEST OF
MANUAL EXPLOSIVES
TRANSPORT VEHICLE (METV)



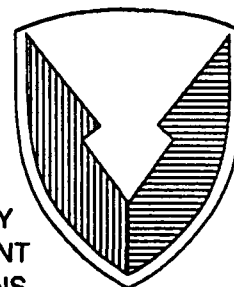
Prepared for:
Lone Star Army Ammunition Plant
ATTN: SMCLS-SF
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1. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS	
2. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION / AVAILABILITY OF REPORT UNLIMITED	
3. DECLASSIFICATION / DOWNGRADING SCHEDULE			
PERFORMING ORGANIZATION REPORT NUMBER(S) 91-04		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. NAME OF PERFORMING ORGANIZATION U.S. Army Defense Ammunition Center and School		6b. OFFICE SYMBOL (if applicable) SMCAC-DEV	7a. NAME OF MONITORING ORGANIZATION
5. ADDRESS (City, State, and ZIP Code) ATTN: SMCAC-DEV Savanna, IL 61074-9639		7b. ADDRESS (City, State, and ZIP Code)	
6. NAME OF FUNDING / SPONSORING ORGANIZATION Lone Star Army Ammunition Plant		8b. OFFICE SYMBOL (if applicable) SMCLS-SF	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
7. ADDRESS (City, State, and ZIP Code) ATTN: SMCLS-SF Texarkana, TX 75501-9101		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) MIL-STD-398 Test of Manual Explosives Transport Vehicle (METV)			
12. PERSONAL AUTHOR(S) A. C. McIntosh			
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 1991 July	15. PAGE COUNT
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP		
19. ABSTRACT (Continue on reverse if necessary and identify by block number) The U. S. Army Defense Ammunition Center and School (USADACS) was tasked by Lone Star Army Ammunition Plant (LSAAP), Texarkana, TX to provide MIL-STD-398, Military Standard Shields, Operational for Ammunition Operations, Criteria for Design of and Tests for Acceptance, instrumentation services for measuring blast overpressure and thermal flux produced by detonating 22.5 ounces of lead azide in the Manual Explosives Transport Vehicle (METV). The METV is used to transport 18 1-oz. containers of lead azide in a shielded container. The spherical barricade shields operators from the explosives while transporting the explosives in the plant. A maximum credible incident (MCI) was defined by LSAAP as a detonation of 22.5 ounces of lead azide. Based on this criteria, two blast pressure gages were placed at the loading door of the barricade, and the other at the side of the transporter. Thermal flux gages were also placed at the same positions as the blast overpressure gages. The test (continued on back)			
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL JEROME H. KROHN		22b. TELEPHONE (Include Area Code) 815-273-8929	22c. OFFICE SYMBOL SMCAC-DEV

19. Abstract (continued).

charge was functioned, then the blast pressure and thermal flux recorded. Blast overpressure levels were too low in amplitude to record. Thermal flux radiation was also too low to record. As a result, the METV met the test requirements of MIL-STD-398, Military Standard Shields, Operational for Ammunition Operations, Criteria for Design of and Tests for Acceptance.

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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NUMBER 91-04
MIL-STD-398 TEST OF
MANUAL EXPLOSIVES TRANSPORT VEHICLE (METV)

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PART 1

INTRODUCTION

A. **BACKGROUND.** The U. S. Army Defense Ammunition Center and School (USADACS) was tasked by Lone Star Army Ammunition Plant (LSAAP), Texarkana, TX to provide MIL-STD-398, Military Standard Shields, Operational for Ammunition Operations, Criteria for Design of and Tests for Acceptance, instrumentation services for measuring blast overpressure and thermal flux produced by detonating 22.5 ounces of lead azide in the Manual Explosives Transport Vehicle (METV). The METV is used to transport 18 1-oz. containers of lead azide in a shielded container. The spherical barricade shields operators from the explosives while transporting the explosives in the plant. A maximum credible incident (MCI) was defined by LSAAP as a detonation of 22.5 ounces of lead azide. Based on this criteria, two blast pressure gages were placed at the loading door of the barricade, and the other at the side of the transporter. Thermal flux gages were also placed at the same positions as the blast overpressure gages. The test charge was functioned, then the blast pressure and thermal flux recorded. Blast overpressure levels were too low in amplitude to record. Thermal flux radiation was also too low to record. As a result, the METV met the test requirements of MIL-STD-398, Military Standard Shields, Operational for Ammunition Operations, Criteria for Design of and Tests for Acceptance.

B. **AUTHORITY.** This test was conducted in accordance with mission responsibilities delegated by U. S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR 740-1, 23 April 1971, Storage and Supply Operations; AMCCOMR 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of this test is to determine if the METV meets the requirements of MIL-STD-398, Military Standard Shields, Operational for Ammunition Operations, Criteria for Design of and Tests for Acceptance; Methods 101, Blast Overpressure; 201, Fragment Retention; and 301, Heat Flux Measurement.

D. CONCLUSIONS.

1. Blast overpressure at the operator's position was less than 0.7 psi reflected and less than 0.4 psi reflected at the loading port. No direct blast overpressure was recorded. The blast pressures recorded were below the 5.0 psi limit for reflected pressure.

2. The METV retained all internally mounted fragments. An exterior rubber knob and dial (EC-11585) separated from the rotating shaft. The rubber knob was found 167 inches from the METV and the dial 109 inches. The energy required to move the rubber knob was 1.74 ft-lbs and 8.175 ft-lbs for the dial. These energetic levels were below the 50 ft-lb limit of AR 380-100.

3. Thermal flux radiation recorded at the operator's position was 0.08 Btu/sq. ft.-sec. and 0.72 Btu/sq. ft.-sec. at the loading door. The maximum amount of radiation for a 0.1 second reaction time is 0.92 Btu/sq-ft-sec.

4. Blast overpressure and heat flux measurements indicated that the shield was effective in shielding the operator from accidental functioning of 22.5 ounces of lead azide. The barricade was effective in retaining internal shrapnel. Two externally attached barricade components separated as a result of the explosion; however, their energy was below the perscribed threshold.

E. RECOMMENDATIONS. It is recommended, to further ensure METV integrity, that it be retested with a redesigned turntable shaft using a smaller hole to feed out the blasting cap wires.

This will yield a higher internal vessel pressure. It is assumed that the feed hole for the blasting cap wire will not be in the METVs used in actual production applications.

PART 2

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PART 3

TEST PROCEDURES

DETAILED REQUIREMENTS

100 Class - Blast Attenuation Tests

200 Class - Fragmentation Tests

300 Class - Thermal Effects Attenuation Tests

CLASS-100 BLAST ATTENUATION TESTS

METHOD 101 BLAST OVERPRESSURE MEASUREMENT

A. PURPOSE:

1. Measurement of blast overpressure is conducted to ensure that personnel are not exposed to peak positive incident overpressure greater than 2.3 psi when the operational shield is subjected to a maximum credible incident (MCI).

2. An acceptable alternate to measuring peak positive incident overpressure is to measure peak positive normal reflected overpressure. Personnel shall not be exposed to a maximum positive normal reflected overpressure greater than 5.0 psi when the operational shield is subjected to an MCI.

B. DESCRIPTION OF TEST. An MCI is created with the operational shield. Blast pressure gages are used to measure blast overpressure.

C. CRITERIA FOR PASSING TEST. The operational shield shall be considered adequate if it can be determined from a pressure-distance plot of the data that personnel will not be exposed to a peak positive incident overpressure above 2.3 psi or a peak positive normal reflected overpressure above 5.0 psi.

D. INSTRUMENTATION. Blast Pressure Gages and Electronic Recording System. Based on the equivalent test charge weight of explosives and anticipated peak overpressure, the instrumentation system shall have the necessary response time and bandwidth to acquire data. Instrumentation shall be calibrated in accordance with current procedures of TB 43-180, Calibration Requirements for the Maintenance of Army Materiel.

E. TEST PROCEDURES:

1. When the shield is tested in a simulated operational bay environment, overpressure readings shall be taken at the following locations:

(a) At the center of probable head locations of each operator. For standing locations, the gages shall be positioned 65 inches above the floor; for sitting locations, it shall be 31.5 inches above the seat.

(b) At representative positions where transient personnel may be located.

2. When testing is conducted in open air, position blast pressure gages around the shield in two or three concentric circles at distances where it is expected that overpressures of interest will be found. Stagger the gages so shock waves reaching the outer circles are not distorted by gages in the inner circle. The gages shall be placed at a height of 65 inches.

3. All instrumentation shall be within calibration at time of test.

4. If the shield is designed for use with more than one model or type of ammunition, select the item that would produce the maximum overpressure.

5. Apply an overload equal to 25 percent or more of the filler weight of the ammunition selected for the test, unless otherwise directed in an approved test plan.

6. All major explosive components should be fuzed separately to ensure simultaneous detonation or deflagration in order to simulate the MCI, unless otherwise directed in an approved test plan.

7. Function explosives and record overpressure readings.

8. Prepare pressure-distance plots from overpressure recordings.

CLASS - 200 FRAGMENT RETENTION TESTS

METHOD 201 FRAGMENT RETENTION TEST

A. PURPOSE. Fragment testing is conducted to verify that a prototype operational shield will:

1. Contain all fragmentation or direct fragmentation away from areas requiring protection.
2. Prevent generation of secondary fragmentation within areas requiring protection.
3. Prevent movement, overturning, or structural deflections which could result in personal injury.

B. DESCRIPTION OF TEST. An MCI is created to test the operational shield.

C. CRITERIA FOR PASSING TEST:

1. Contain all fragmentation or direct fragmentation away from areas requiring protection.
2. Prevent generation of secondary fragmentation within areas requiring protection.
3. Prevent movement, overturning, or structural deflections which could result in personal injury.

D. TEST EQUIPMENT. Still picture camera equipment.

E. TEST PROCEDURES:

1. Fragment Retention Test.

(a) If the shield is designed for use with more than one mode or type of ammunition, select that item which will have the greatest potential fragmentation or shape charge effect.

Equipment, or reasonable simulation thereof, which shall perform the intended function on the ammunition, shall be positioned to generate secondary fragments.

(b) Apply an overload equal to 25 percent or more of the filler weight of the ammunition selected for the test, unless otherwise directed in an approved test plan.

(c) All major explosive components should be fuzed separately to ensure simultaneous detonation or deflagration in order to simulate the MCI, unless otherwise directed in the approved test plan.

(d) Function explosives.

2. Post-Test Procedures:

(a) Examine the interior and exterior for evidence of fragments. Photograph the shield to document the results.

(b) Examine the shield for movement, overturning, or structural deflections which could result in personal injury.

(c) Shields designed for intentional detonation shall be examined for damage and an estimate made as to the ability of the shield to remain operational as specified in the design criteria.

CLASS - 300 THERMAL EFFECTS MEASUREMENT

METHOD 301 HEAT FLUX MEASUREMENT

A. PURPOSE. Heat flux measurement is a condition of measure that personnel are not exposed to a maximum radiant heat flux determined in the equation given in criteria for passing test of this standard.

B. DESCRIPTION OF TEST. An MCI is created. Heat flux transducers are used to measure radiant heat flux.

C. CRITERIA FOR PASSING TEST. The operational shield shall be considered acceptable if it can be determined from heat flux-distance and heat flux-time plots to the test data that personnel will not be exposed to a radiant heat flux rating exceeding the formula:

$F = 1.0 / [(0.62t)^{0.7423}]$ cal/cm²-sec, where F is the thermal flux, T is the time in seconds.

D. INSTRUMENTATION. Heat Flux Transducers and Electronic Recording System. Based on the thermal flux expected at the location of the transducers, the instrumentation system shall have the necessary response time and bandwidth to acquire data. Instrumentation shall be calibrated in accordance with current procedures of TB 43-180, Calibration Requirements for the Maintenance of Army Material.

E. TEST PROCEDURES:

1. When the shield is tested in a simulated operational bay environment, heat flux readings shall be taken at the following locations:

(a) At the center of probable head locations of each operator. For standing locations the transducers shall be positioned 65 inches above the floor; for sitting locations it shall be 31.5 inches above the seat.

(b) At representative positions where transient personnel may be located.

2. In a free field test, flux values at various distances from the point of detonation can be estimated by the relationship: $O_1 \times d_1^2 = O_2 \times d_2^2$, where O =heat flux in Btu/in²-sec, and d =distance from point of detonation.

3. All instrumentation shall be within calibration at time of test.

4. If the shield is designed for use with more than one model or type of ammunition, select the item for the greatest heat flux.

5. Apply an overload equal to 25 percent or more of the filler weight of ammunition selected for the test, unless otherwise directed in an approved test plan.

6. All major explosive components should be fuzed separately to ensure simultaneous detonation or deflagration in order to simulate the MCI, unless otherwise directed in an approved test plan.

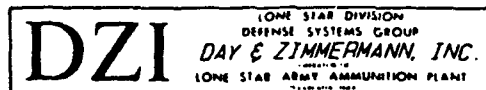
7. Function explosives and record radiant flux readings.

8. Prepare heat flux-distance and heat flux-time plots from radiant flux recordings.

PART 4

LONE STAR ARMY AMMUNITION PLANT

TEST PROCEDURE



EM-8500/QAT/DK
MARCH 27, 1990

TECHNICAL PROGRAM NUMBER LS-322

SUBJECT: TESTING OF PROPOSED METV DEVICE FOR CONTAINMENT OF INITIATING EXPLOSIVES UTILIZED IN DETONATOR PRODUCTION, DRAWING NUMBER EC-11585.

PURPOSE: TO DETERMINE IF THE PROPOSED METV DEVICE WILL ADEQUATELY CONTAIN THE EXPLOSION OF 22.5 OUNCES OF LEAD AZIDE. THIS AMOUNT IS EQUIVALENT TO THE MAXIMUM AMOUNT OF EXPLOSIVES TO BE UTILIZED IN THE UNIT PLUS A 25% SAFETY FACTOR.

DISCUSSION: THE PROPOSED METV DEVICE WILL BE USED TO TRANSPORT INITIATING EXPLOSIVES FROM PROCESS BARRICADES TO THE FRONT LOAD LINE. ONCE THE METV HAS ARRIVED AT THE FRONT LINE, IT THEN WILL INTERFACE TO THE LOAD BAY WALL AND SERVE AS A STORAGE CONTAINER. PRODUCTION PERSONNEL WILL REMOVE, ON AN AS NEEDED BASIS, EITHER NOL 130 OR LEAD AZIDE, AND TRANSFER THE EXPLOSIVES TO THE DETONATOR MACHINE. WHEN THE METV IS EMPTY, IT CAN BE TRANSPORTED TO THE BACK LINE FOR REFILLING. IN EITHER CASE, THE METV IS A UNIT THAT MUST CONTAIN A DETONATION WITHIN ITSELF AND OFFER NO PERSONNEL INJURY OR STRUCTURAL DAMAGE. DURING THE TEST, THE METV WILL BE POSITIONED AT A SUITABLE LOCATION IN XX AREA. IN ORDER TO DUPLICATE ACTUAL IN USE CONDITIONS, LEAD AZIDE WILL BE DETONATED WITH A #6 IRECO BLASTING CAP. IT IS IMPERATIVE THAT THE LEAD AZIDE BE UTILIZED IN THE TEST TO PROVIDE ACCURATE THERMAL FLUX DATA. IN THE PAST, RDX EQUIVALENT, RATHER THAN AZIDE OR NOL 130, COULD BE READILY SUBSTITUTED TO PROVIDE FRAGMENT RETENTION AND STRUCTURAL INTEGRITY DATA. RECENT TESTS INDICATE TOTALLY DIFFERENT RESULTS BETWEEN LEAD AZIDE AND RDX EQUIVALENTS WHEN MEASURING THERMAL FLUX AND BLAST OVERPRESSURE. THE LEAD AZIDE WILL BE TRANSFERRED FROM P-76 PRE-DRY BAY IN A DRYING TUBE, IN A MOIST OR WET CONDITION, TO P-20. BUILDING P-20 IS EQUIPPED WITH A REMOTE SET OF SCALES AND THE EXACT WEIGHT OF THE LEAD AZIDE CAN BE ACHIEVED AT THIS POINT. THE AZIDE WILL REMAIN IN A DRYING TUBE, BE PLACED IN A LARGE RUBBER BUCKET, AND SUBMERGED WITH ALCOHOL. IT WILL THEN BE TRANSPORTED TO XX TEST AREA BY SPECIAL PANEL TRUCK AT A SPEED NO GREATER THAN 15 MPH. THE ROUTE TAKEN SHALL BE ON PAVED SURFACES WITH LSAAP SECURITY GUARD ESCORT, FRONT AND REAR. ONE SECURITY GUARD SHALL REMAIN WITH THE PANEL UNTIL THE AZIDE IS REMOVED BY TECHNICAL REPRESENTATIVES AT XX AND HAND CARRIED DIRECTLY TO THE TEST SITE. THE TUBE SHALL BE REMOVED FROM THE RUBBER BUCKET CONTAINING ALCOHOL AND PLACED INTO AN ADDITIONAL EMPTY RUBBER BUCKET FOR DECANTING OF THE EXCESS ALCOHOL. AFTER A DECANTING PERIOD OF 15 MINUTES, THE TUBE OF AZIDE WILL BE REMOVED FROM THE RUBBER BUCKET AND PLACED INTO THE METV DIRECTLY ON TOP OF A RUBBER PIE PLATE. STILL PHOTOGRAPHS, BEFORE AND AFTER DETONATION, WILL BE TAKEN TO ASSIST IN DETERMINING FRAGMENT RETENTION CAPABILITIES. FASTEX FILMING OF THE EXPLOSION WILL ALSO OCCUR TO

TECHNICAL PROGRAM NUMBER LS-322

DOCUMENT THE EVENT AND SUPPORT THE EVALUATION OF THE DEVICE. PERSONNEL AND ELECTRONIC EQUIPMENT FROM USADACS WILL BE PRESENT TO DETERMINE BLAST OVERPRESSURE AND THERMAL FLUX. THE SENSORS FOR THESE DATA GATHERING DEVICES WILL BE LOCATED IN CLOSE PROXIMITY TO THE METV TO DUPLICATE PERSONNEL POSITIONING DURING ACTUAL PRODUCTION USE. USADACS TECHNICIANS WILL DETERMINE EXACT LOCATIONS FOR SENSORS TO ENSURE ACCURATE DATA. THE TEST WILL BE CONDUCTED WITH THE SERVICE DOOR, OR PORT, IN THE CLOSED POSITION.

PROCEDURE: THE METV WILL BE POSITIONED FOR TESTING IN XX 76 TEST AREA. THE 22.5 OUNCES OF LEAD AZIDE WILL BE POSITIONED IN THE METV IN A SINGLE CONTAINER IN THE APPROXIMATE CENTER OF THE UNIT ON TOP OF THE RUBBER PIE PLATE. A #6 IRECO BLASTING CAP WILL BE GENTLY PLACED INTO THE STILL DAMP AZIDE WITH THE LEAD WIRES RUN TO THE OUTSIDE. IF NECESSARY, A PAIR OF SUPPLEMENTAL LEAD WIRES WILL BE ATTACHED TO THE BLASTING CAP AND SHUNTED. THE SERVICE DOOR WILL THEN BE CLOSED TO THE METV.

THE FIELD LINES WILL BE SHUNTED AT THE CONNECTOR BOX AND CHECKED AT THE BARRICADE END FOR CONTINUITY AND EXTRANEIOUS ELECTRICITY. IF THE CIRCUIT IS COMPLETE AND NO EXTRANEIOUS ELECTRICITY IS DETECTED, THE LEAD WIRES AND FIELD LINE WILL BE CONNECTED. A WAITING PERIOD OF APPROXIMATELY 1 HOUR WILL THEN BE OBSERVED TO ALLOW THE AZIDE TO DRY AND NO PERSONNEL WILL BE ALLOWED TO APPROACH THE DEVICE TO BE TESTED.

THE CIRCUIT WILL BE CHECKED AT THE CONNECTOR BOX. IF NO DEFICIENCIES EXIST IN THE CIRCUIT, THE TECHNICAL SUPERVISOR WILL ASCERTAIN THAT ALL PERSONS ARE IN THEIR PROPER LOCATIONS. THE BLASTING MACHINE WILL THEN BE INTRODUCED TO THE CIRCUIT AND ACTIVATED.

SAFETY REQUIREMENTS: ALL ELECTRICAL CONNECTIONS WILL BE TAPED TO ENSURE ADEQUATE INSULATION.

THE CIRCUIT CONNECTOR BOX AND THE BLASTING MACHINE WILL BE LOCKED AT ALL TIMES EXCEPT WHEN FIRING. THE KEY WILL BE IN THE POSSESSION OF THE TECHNICAL SUPERVISOR.

TECHNICIANS AND PRODUCTION PERSONNEL HANDLING THE LEAD AZIDE WILL WEAR PROPER PROTECTIVE CLOTHING AND FOOTWEAR.

PERSONNEL LIMITS: ONLY THE TECHNICIAN IN CHARGE AND THE TEST AREA SUPERVISOR WILL BE ALLOWED IN THE VICINITY OF THE BARRICADE WHEN EXPLOSIVES ARE BEING INTRODUCED OR ELECTRICAL CONNECTIONS ARE BEING MADE AT THE METV. THE TECHNICIANS WILL BE LOCATED AT A SAFE DISTANCE FROM THE TEST SITE AND IN A PROTECTED ENVIRONMENT DURING THE ACTUAL

TECHNICAL PROGRAM NUMBER LS-322

DETONATION OF THE EXPLOSIVES. OTHER PERSONNEL WILL BE LOCATED AT THE XX OFFICE BUILDING FROM THE TIME THE AZIDE ARRIVES AT XX AND DURING THE ACTUAL TEST.

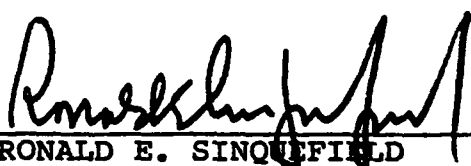
NOTE: DAY & ZIMMERMANN AND ACO SAFETY OFFICES WILL BE NOTIFIED PRIOR TO THE TEST. FASTEX AND STILL PHOTOGRAPHS WILL RECORD EVENTS TRANSPIRING DURING THE ACTUAL TESTING OF THE METV.

STANDING ORDER #63 WILL BE FOLLOWED IN EVENT OF ANY UNUSUAL OCCURRENCE.

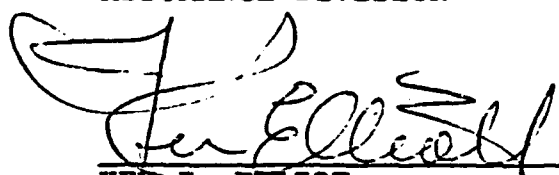
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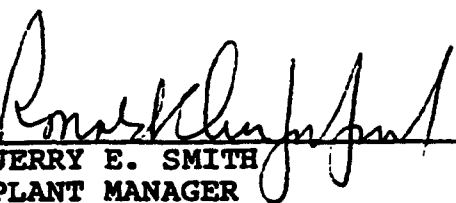

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PART 5

TEST RESULTS

A. Blast Overpressure. Method 101:

1. At operator's position: Less than 0.7 psi
2. At loading port: Less than 0.4 psi

B. Fragment Retention Test. Method 201: The METV retained all internally mounted fragments. An externally mounted rubber knob and dial (EC-11585) separated from the rotating shaft. The rubber knob was found 167 inches from the METV, and the dial 109 inches from the METV. The energy required to move the rubber knob was 1.74 ft-lbs and 8.175 ft-lbs for the dial. These energetic levels were below the 50 ft-lb limit of AR 385-100.

C. Heat Flux Measurements. Method 301:

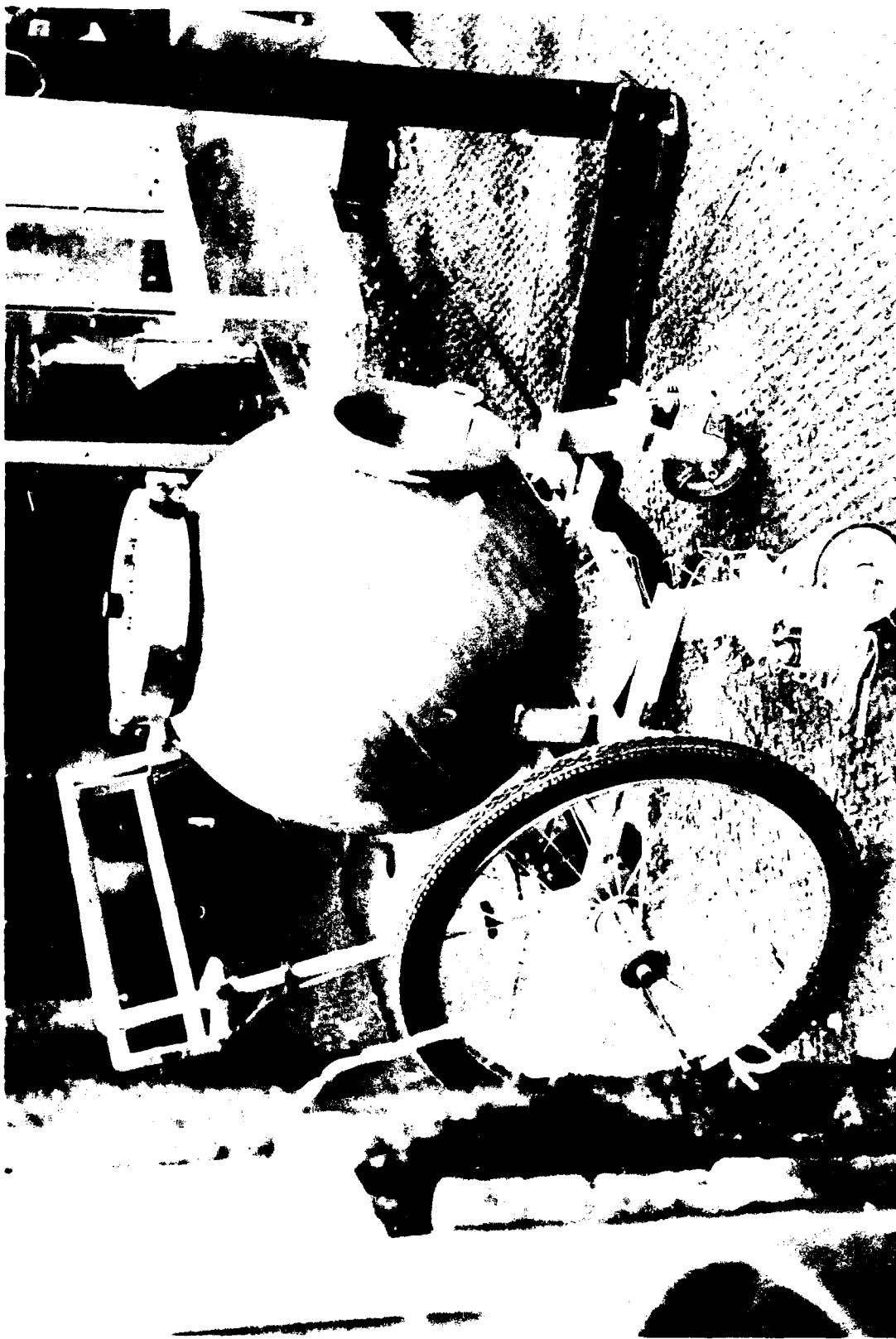
1. At operator's position: 0.08 Btu/sq. ft.-sec.
2. At loading port: 0.72 Btu/sq. ft.-sec.

Note: Recorded blast pressures were reflected. No incident blast peak pressure was recorded.

D. It was observed that the METV effectively retained all internal metal parts. The hole drilled at the bottom to allow insertion of the blasting cap leads, provided venting of the explosive gases. Also, explosive gases vented from the rotating bearing on the indexing shaft assembly. The dial and rubber knob, mounted externally, separated from the shaft and probably were blown vertically into the air from functioning the lead azide. Since the vertical rise of these components was not known, the total amount of energy imparted to them from the explosion could not be calculated.

PART 6

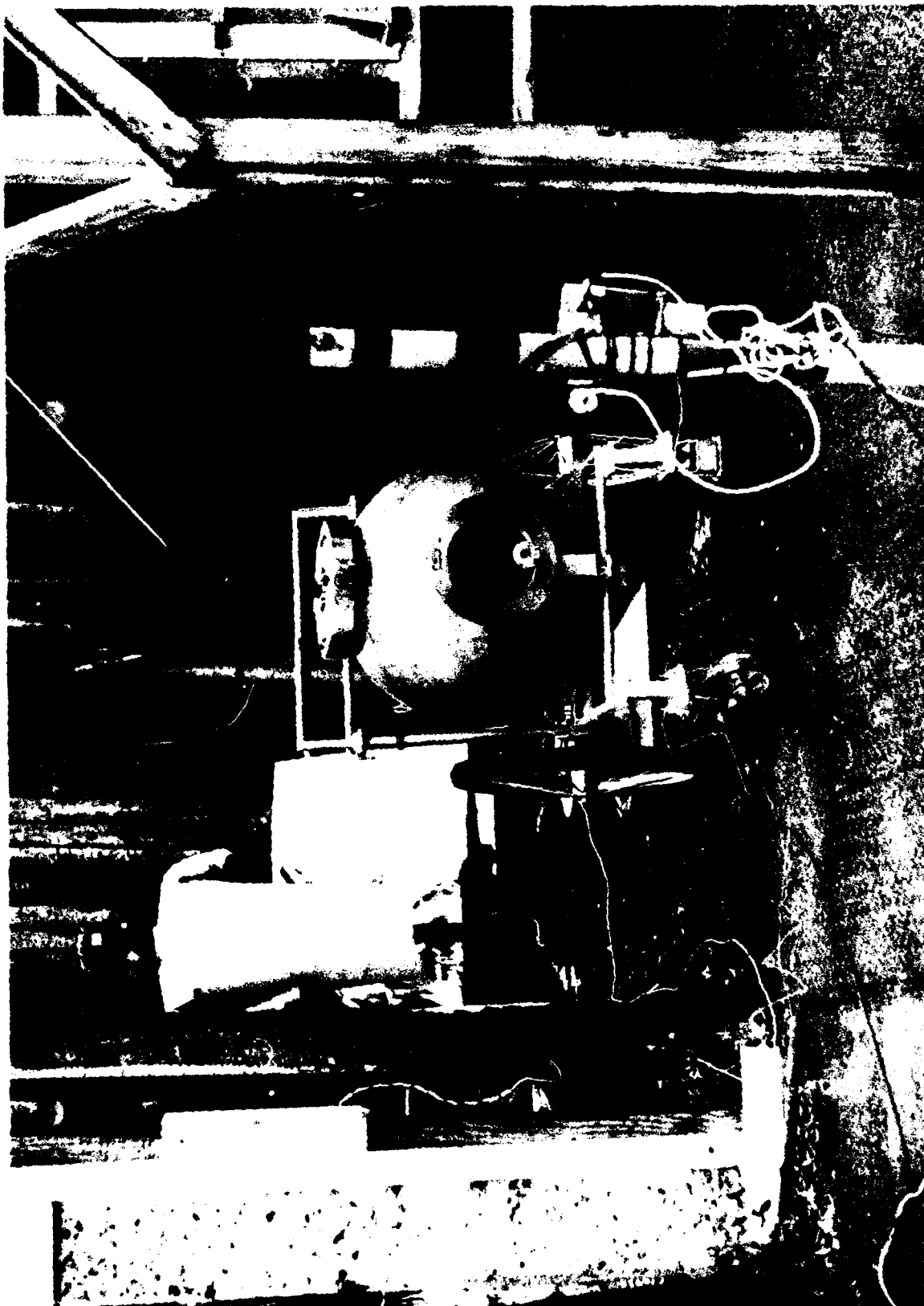
PHOTOGRAPHS



6-2

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SCN91-194-2038-91. This photo shows the METV before functioning 22.5 ounces of lead azide inside the protective sphere. Note, the blasting cap leads under the vehicle. The top collar assembly has a bearing that supports a turntable for dispensing 1 ounce containers of lead azide. There is an indexing locking lever and a rubber knob to facilitate manual rotation.



6-3

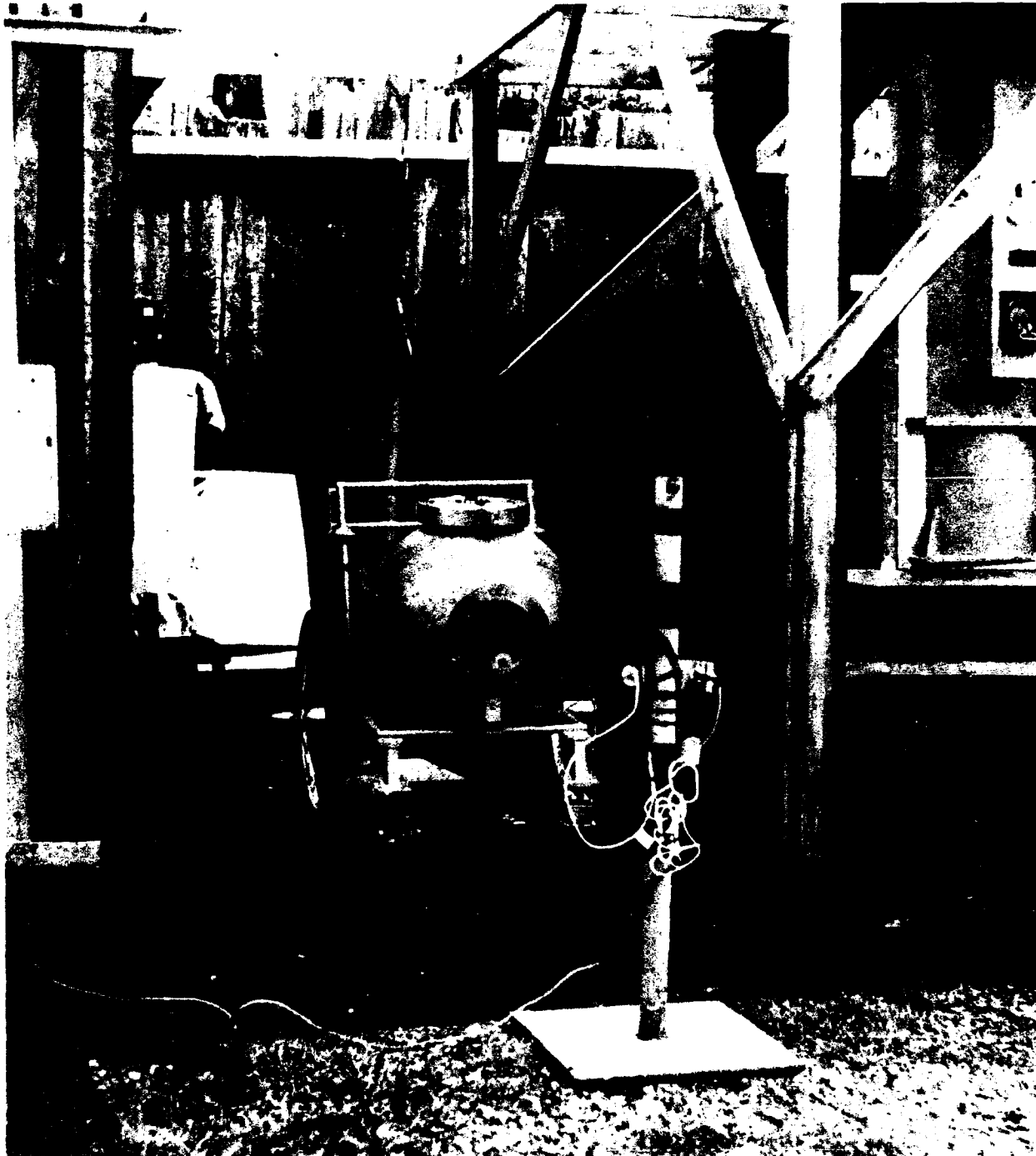
U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SCN91-194-2039-9. This photo shows the METV before functioning 22.5 ounces of lead azide. Note, the blast overpressure and thermal flux gages. One is positioned at the operator's position (behind the vehicle). The other gage set is placed in line with the access port.



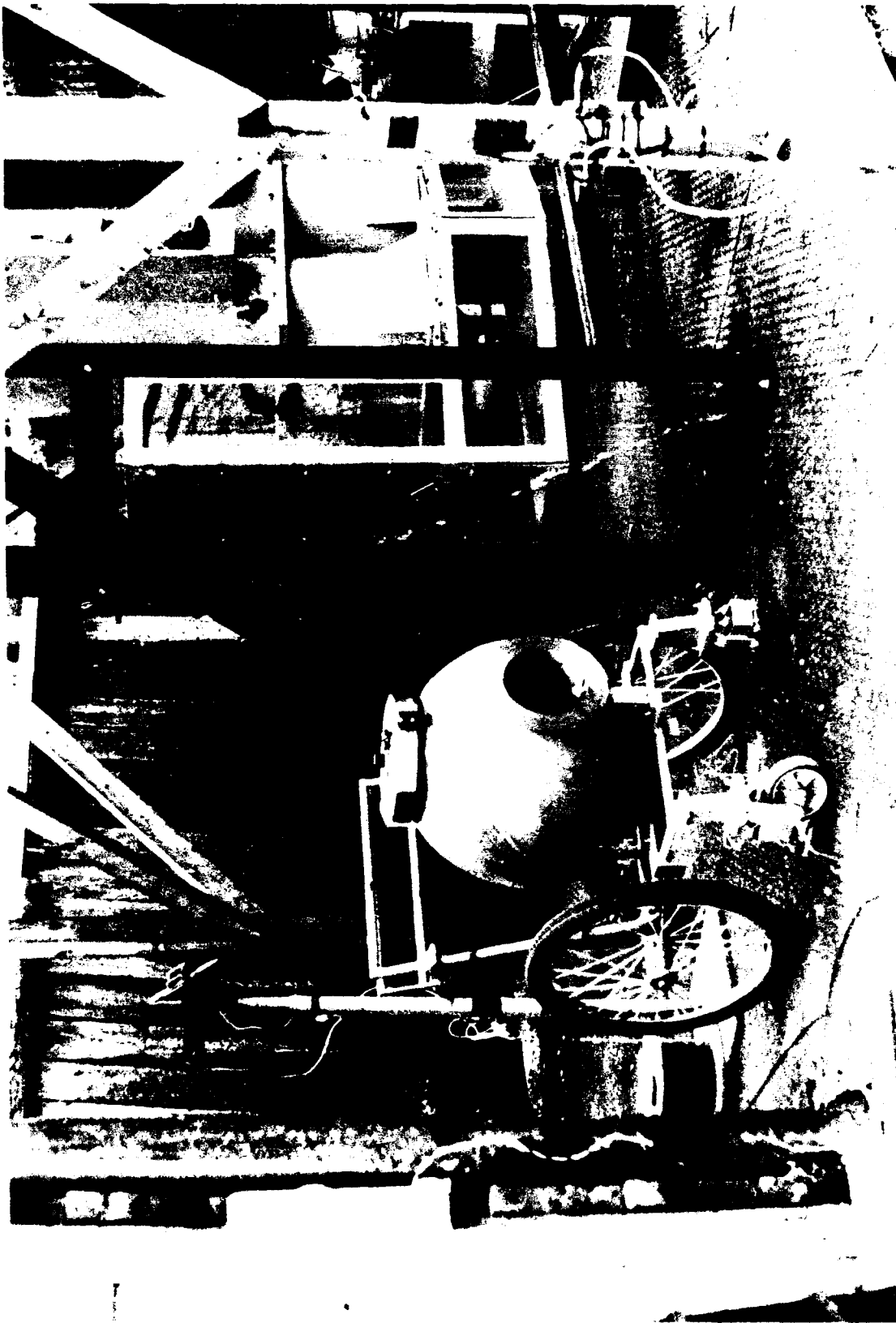
	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
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Photo No. AO317-SCN91-194-2040-9. This photo shows the METV before functioning 22.5 ounces of lead azide. Note, the blast overpressure and thermal flux gages. One is positioned at the operator's position (behind the vehicle). The other gage set is placed in line with the access port.



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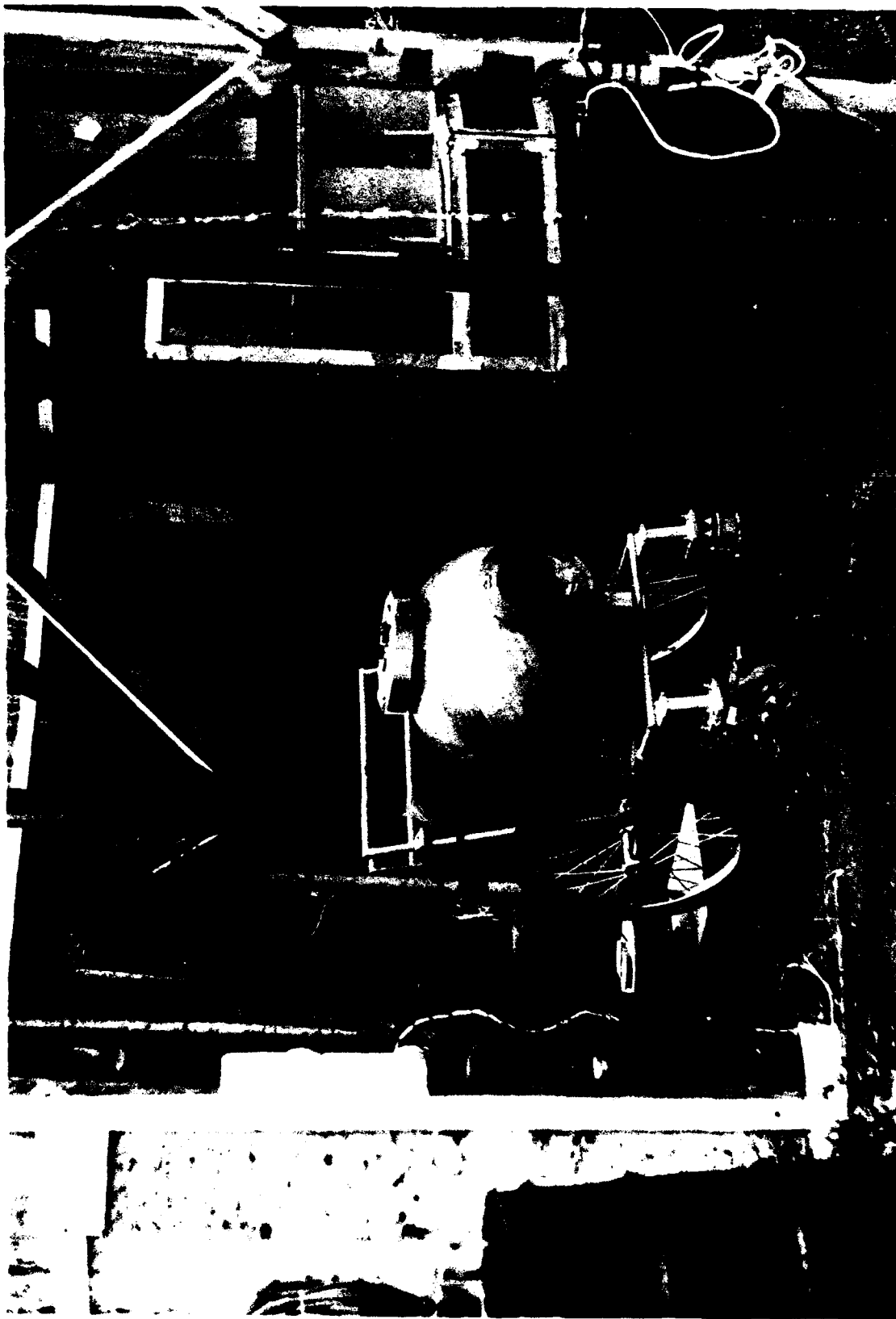
Photo No. AO317-SCN91-194-2041-9. This photo shows the METV before functioning 22.5 ounces of lead azide. Note, the blast overpressure and thermal flux gages. One is positioned at the operator's position (behind the vehicle). The other gage set is placed in line with the access port.



6-6

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Photo No. AO317-SCN91-194-2042-9. This photo shows the METV before functioning 22.5 ounces of lead azide. Note, the blast overpressure and thermal flux gages. One is positioned at the operator's position (behind the vehicle). The other gage set is placed in line with the access port.



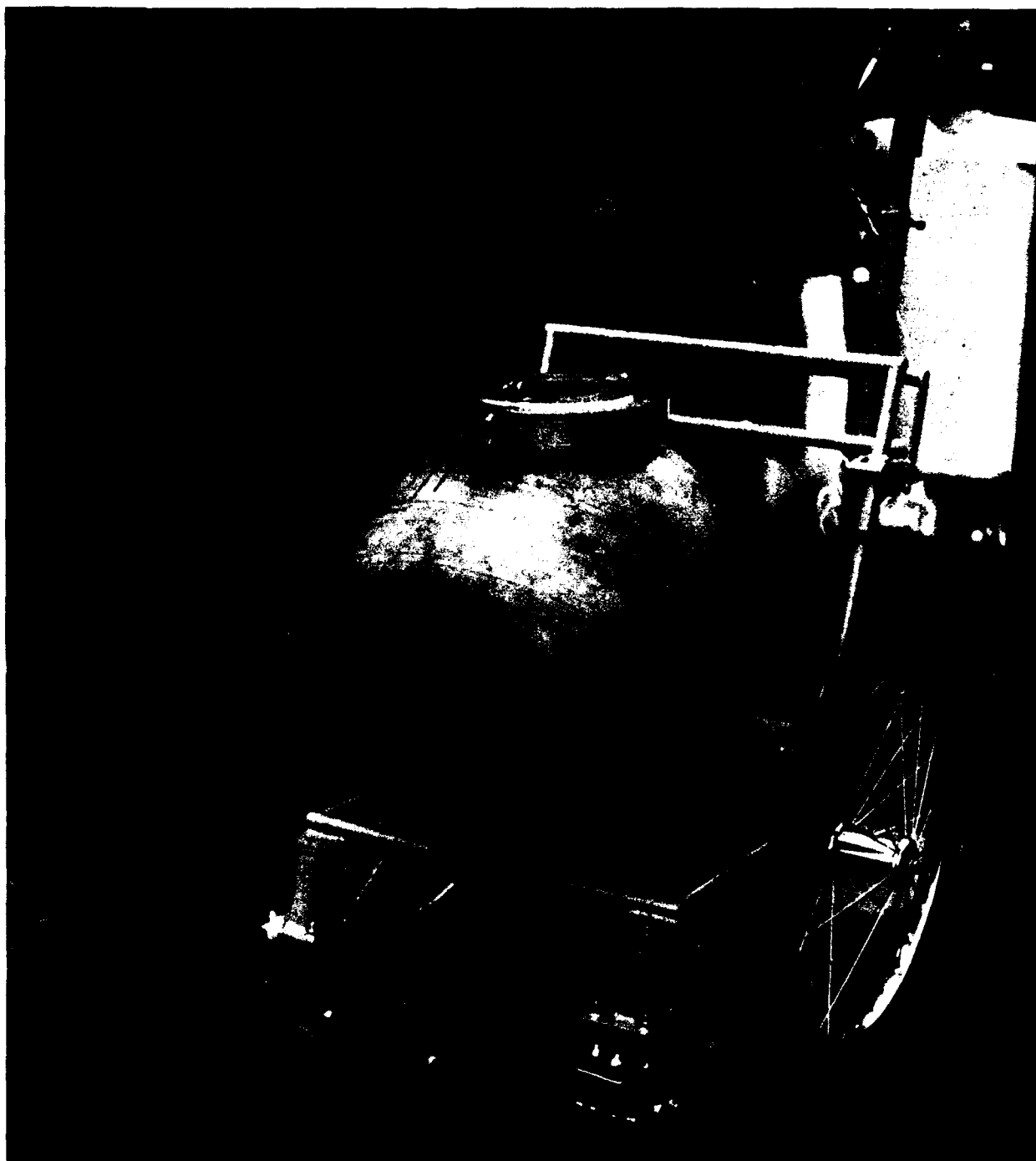
U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SCN91-194-2043-9. This photo shows the METV before functioning 22.5 ounces of lead azide. Note, the blast overpressure and thermal flux gages. One is positioned at the operator's position (behind the vehicle). The other gage set is placed in line with the access port.



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Photo No. AO317-SCN91-194-2044-9. This photo shows the METV after functioning 22.5 ounces of lead azide. Note, the missing index plate and rubber knob. The black liquid leaking down the sphere is bearing lubrication.



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Photo No. AO317-SCN91-194-2045-9. This photo shows the METV after functioning 22.5 ounces of lead azide. The vehicle has "dead man brakes,"; that is, the double bar must be squeezed together by the operator before the vehicle can be moved. There was no movement of the vehicle in any direction, as a result of the explosion.